XI. "On the Normal Paraffins. Part III." By C. SCHORLEMMER, F.R.S., Professor of Organic Chemistry in Owens College, Manchester. Received August 2, 1879.

(Abstract.)

The isomeric monochlorides, obtained from the normal paraffins existing in petroleum, yield by the abstraction of hydrochloric acid a mixture of olefines, one portion of which readily combines with hydrochloric acid in the cold, whilst the other unites with it only on heating.*

The chlorides formed in the cold boil with partial decomposition and at a lower temperature than the others, which distil without undergoing any change, and have the general formula

$$CH_3—CHCl—C_nH_{2n+1}.$$†

They are therefore derived from the olefines of the series

$$CH_2{=}CH—C_nH_{2n+1}.$$

Similar results have been obtained by Le Bel.‡

The constitution of the olefines combining with the acid in the cold is not yet known. They are possibly not derived from normal paraffins, but from isomerides, which cannot be separated from the former by distillation. On the other hand their formation can also be explained without making this assumption. This question can only be decided by using an absolutely pure paraffin.§

For this purpose, normal hexane from mannite was selected, which possibly might yield three isomeric monochlorides:

(1.) $CH_3—CH_2—CH_2—CH_2—CH_2—CH_2Cl$
(2.) $CH_3—CH_2—CH_2—CH_2—CHCl—CH_3$
(3.) $CH_3—CH_2—CH_2—CHCl—CH_2—CH_3$

The formation of the first two has already been proved.‖ The following seemed capable of determining whether the third is also produced. By the abstraction of hydrochloric acid three hexylenes might be formed:—

Butylethylene	$CH_3—CH_2—CH_2—CH_2—CH{=}CH_2$
Methylpropylethylene ..	$CH_3—CH_2—CH_2—CH{=}CH—CH_3$
Diethylethylene	$CH_3—CH_2—CH{=}CH—CH_2—CH_3$

The first of these does not combine with cold hydrochloric acid; the second is the hexylene obtained from secondary hexyl iodide.‖

* "Journ. Chem. Soc.," 1873, p. 319.
† Morgan, *ibid.*, 1875, p. 301.
‡ "Bull. Soc. Chim.," (2), xxviii, p. 460.
§ "Journ. Chem. Soc.," 1875, p. 306.
‖ Hecht, "Deut. Chem. Ges. Ber.," xi, p. 1152.

Le Bel and Wassermann have found that cold hydrochloric acid has no action on it, from which it follows that, if normal hexane from mannite yields a hexylene combining with hydrochloric acid in the cold, it could be only diethylhexylene, which could be easily identified by conversion into ethylpropyl carbinol and oxidising it, when only propionic acid should be formed.

This was my programme; the results were, however, quite unexpected.

The hexylene obtained by decomposing the hexyl chlorides was left in contact with cold fuming hydrochloric acid for some weeks. *The whole of it combined and the hexyl chloride thus formed boiled constantly and without the least decomposition* at 124—125°. It was converted into the alcohol, which on oxidation yielded only acetic acid and butyric acid, and consequently is methylbutyl carbinol. We have, therefore, the remarkable fact, that two hexanes exist, which must be regarded as normal compounds, and therefore according to our present theory, to be identical. This is, however, not the case. I have already in my first paper pointed out some other differences existing between the two hexanes, but left the question open, whether these are caused by impurities contained in the hexane from petroleum, or whether we have here a case of fine isomerism, for which an explanation has to be found.* I believe the results of my present research speak strongly in favour of the latter view.

For several reasons I am inclined to believe that petroleum consists chiefly of an inextricable mixture of isomeric and homologous paraffins, in which, however, the normal hydrocarbons preponderate. This would certainly explain why it is so difficult to isolate from it bodies having a constant boiling point,† but not the differences exhibited by the two hexanes.

A continuation of these researches has already been commenced. My friend Thorpe, who has made the most interesting discovery that the terebinthinate exudation of *Pinus Sabiniana* contains a large quantity of normal heptane,‡ has kindly offered me to join him in the chemical investigation of this hydrocarbon. At the same time we shall compare it with other "normal" heptanes from different sources.

XII. "The Geometric Mean, in Vital and Social Statistics." By Francis Galton, F.R.S. Received October 21, 1879.

My purpose is to show that an assumption which lies at the basis of the well-known law of "Frequency of Error" (commonly expressed

* "Phil. Trans.," vol. clxii, p. 119.

† "Journ. Chem. Soc.," 1875, p. 306.

‡ "Journ. Chem. Soc.," 1879, p. 296.